

CLAIMS

What is claimed is:

1. A component assembly suitable for use in living tissue comprising:
a stainless steel part;
a titanium part; and
a filler material comprising at least one nickel foil layer and at least one titanium foil layer for bonding said stainless steel part to said titanium part.
2. The component assembly of claim 1, wherein said at least one nickel foil layer is adjacent said titanium part.
3. The component assembly of claim 1, wherein:
said filler material has a top and a bottom outer surface; and
said at least one nickel foil layer comprises the top and the bottom outer surfaces of said filler material.
4. The component assembly of claim 1, wherein:
said filler material has a top and a bottom outer surface; and
said at least one titanium foil layer comprises the top and the bottom outer surfaces of said filler material.
5. The component assembly of claim 1, wherein said stainless steel part is selected from the group consisting of 200, 300, and 400 series stainless steel.
6. The component assembly of claim 1, wherein said stainless steel part is comprised of 316L stainless steel.
7. The component assembly of claim 1, wherein said titanium part is selected from the group consisting of titanium and titanium alloys.

8. The component assembly of claim 1, wherein said titanium part is comprised of Ti-6Al-4V.

9. The component assembly of claim 1, wherein said filler material reacts with and forms a bond between said titanium part and said stainless steel part.

10. The component assembly of claim 1 wherein:
said filler material has a thickness no greater than about 0.010 inches; and
said component assembly being heated to a temperature that is less than the melting point of said titanium part or of said stainless steel part, but that is greater than the melting point of said filler material, thereby forming a bond.

11. The component assembly of claim 1, wherein said at least one nickel foil layer and said at least one titanium foil layer are formed by a chemical process selected from the group consisting of electroless plating and electroplating.

12. The component assembly of claim 1, wherein said at least one nickel foil layer and said at least one titanium foil layer are formed by a thermal process selected from the group consisting of sputtering, evaporating, and ion beam enhanced deposition.

13. The component assembly of claim 1, wherein said at least one nickel foil layer and said at least one titanium foil layer are formed from metallic particulate.

14. A method of bonding a stainless steel and titanium component assembly, comprising the steps of:

- selecting a stainless steel part;
- selecting a titanium part;
- selecting a laminated filler material that is less than about 0.010 inches thick that is comprised of a 22% to 98% nickel portion and a remaining titanium portion, said laminated filler material comprising at least one nickel foil layer and at least one titanium foil layer,
- selecting said laminated filler material having a melting point that is lower than the melting point of said titanium part and said stainless steel part;
- positioning said filler material between said stainless steel part and said titanium part;
- placing the assembly in a non-reactive atmosphere;
- applying a force to said stainless steel part and said titanium part to place said filler material in compression, thereby creating intimate contact between said stainless steel part, said filler material, and said titanium part;
- heating the assembly to a bonding temperature between said melting point of said laminated filler material and said melting point of said titanium part;
- holding the assembly at said bonding temperature for a predetermined time to form a bond between said stainless steel part and said titanium part; and
- cooling the assembly.

15. The method of claim 11 wherein said step of applying a force creates compression between about 5 and 50 psi.

16. The method of claim 11 wherein said step of applying a force creates compression between about 5 and 7 psi.

17. The method of claim 11 wherein said step of selecting a stainless steel part is selecting from the group consisting of 200, 300, and 400 series stainless steel.

18. The method of claim 11 wherein said step of selecting a titanium part is selecting from the group consisting of substantially pure titanium and its alloys.

19. The method of claim 11 wherein said step of selecting a titanium part is selecting said part comprised of Ti-6Al-4V.

20. The method of claim 11 further comprising the step of applying said filler material chemically.

21. The method of claim 11 further comprising the step of applying said filler material thermally.

22. The method of claim 11 further comprising the step of forming said filler material from metallic particulate.

23. The method of claim 11 further comprising the step of placing the assembly in a non-reactive atmosphere is placing in a vacuum less than 10^{-5} torr.

24. The method of claim 11 further comprising the step of placing the assembly in a non-reactive atmosphere is placing in argon gas.

25. The method of claim 11 wherein said bonding temperature is between approximately 940° and 1260°C.

26. The method of claim 11 wherein said predetermined time is between approximately 5 and 60 minutes.

27. The method of claim 11 additionally comprising the step of cleaning said component assembly after bonding to remove elemental nickel and nickel salts.

28. The method of claim 27 additionally comprising the step of cleaning said component assembly after bonding by placing it in an acid bath.

29. A method of bonding a titanium part to a stainless steel part forming a component assembly, comprising the steps of:

selecting a stainless steel part from the group consisting of corrosion resistant stainless steels;

selecting a titanium part comprised of Ti-6Al-4V;

positioning a filler material between said stainless steel part and said titanium part;

applying a force to said stainless steel part and said titanium part to place said filler material in compression, thereby forming a component assembly;

placing said component assembly in a non-reactive atmosphere;

heating said component assembly to between approximately 940° and 1260°C for between approximately 5 and 60 minutes; and

cooling said component assembly.

30. A method of bonding a stainless steel part to a titanium part to form a component assembly for placement in living tissue in which a filler material is placed between the two parts to be bonded, applying a compressive force of 5 to 50 psi to said stainless steel part and said titanium part so as to place said filler material in compression to form intimate contact between said stainless steel part and said titanium part, said filler material having a melting point that is lower than the melting point of said titanium part or of said stainless steel part, and in which said component assembly, comprising said stainless steel part, said titanium part and said filler material, is placed at a bonding temperature, for a predetermined time, that is less than the melting point of said titanium part or said stainless steel part, but where said bonding temperature is greater than the melting point of said filler material, selecting said stainless steel part from the group consisting 200, 300, and 400 series stainless steel, selecting said titanium part from the group consisting of titanium and titanium alloys, wherein the improvement comprises:

selecting said filler material to be a laminated filler material comprised of at least one foil layer of titanium and at least one foil layer of nickel; and

selecting said bonding temperature between approximately 940° and 1260°C.